Department of Energy
Office of Nuclear Physics Report

on the

Annual Progress Review

of the

Electron Beam Ion Source Project

May 15-16, 2006

Executive Summary

The Department of Energy (DOE) Office of Nuclear Physics (NP), with participation from the Office of Science for Project Assessment, held an Annual Progress Review of the Electron Beam Ion Source (EBIS) Project at Brookhaven National Laboratory (BNL) on May 15-16, 2006.

The Relativistic Heavy Ion Collider (RHIC) at the BNL is the flagship heavy ion research facility in the Nation. Counter-rotating beams of nuclei from hydrogen to gold are accelerated to energies of hundreds of GeV and collided head on. Currently, heavy ions are provided for injection into the Alternating Gradient Synchrotron (AGS) and then into RHIC by either of two aging Tandem Van de Graff accelerators. The EBIS will provide a versatile, reliable and cost effective replacement for the existing tandem injector. The principal objectives of this project are to provide a more reliable and stable source of ions, to enable the use of a wider range of nuclear species, to increase the luminosity of RHIC, and to provide for more cost-effective operations of RHIC. The EBIS-based pre-injector will replace the Van de Graff accelerators as injector for the National Aeronautics and Space Administration (NASA) Space Radiation Laboratory (NSRL). In this context it would provide improved stability and reliability, a wider range of nuclear species, as well as the capability of switching rapidly between different species.

The DOE Total Project Cost (TPC) of the EBIS project is $14.8 million in actual year dollars. NASA is contributing an addition $4.5 million for a total investment of $19.3 million. DOE is responsible for the management of the project. The project scope (DOE and NASA) consists of an EBIS ion source, a Radio Frequency Quadrupole (RFQ) accelerator, a short Linear Accelerator (Linac), a short transport line to the Booster Accelerator, and related instrumentation.

Critical Decision-0 (CD-0, Approve Mission Need) for the EBIS project was approved by Dr. Raymond L. Orbach, Director, Office of Science, on August 2, 2004. Critical Decision-1 (CD-1, Approve Alternate Section and Cost Range) was approved by Dr. Dennis Kovar, Associate Director of the Office of Nuclear Physics, Office of Science on September 29, 2005. This Annual Project Review was organized in preparation for Critical Decision-2 (CD-2, Approve Performance Baseline).

The review panel confirmed the merit of the project. EBIS will expand the capabilities of the RHIC facility and reduce its maintenance & operations costs by ~$1.5 million/year. The EBIS-based injector is expected to provide all presently delivered ion beams to the AGS booster synchrotron with the same or higher beam currents, and in addition many heavy-ion beams that are of interest to RHIC as well as NSRL, up to uranium. Furthermore, the new injector will operate with higher availability and reliability than the tandem injectors.

The preliminary design is complete, and in many key areas, advanced in regards to preparations for CD-2. A Memorandum of Understanding (MOU) has been signed with

Frankfurt University on the development and construction of the RFQ; they are also being considered as the vendor for the Linac. The design of these elements would follow closely on designs of existing operational devices built by Frankfurt University and its associated manufacturers. It is important that a strong quality assurance program be built into the contract that would require careful control and monitoring of the work progress. End-to-end beam dynamics simulations have been started but do not yet include a full set of errors, such as the Linac alignment errors, which will be important for understanding the EBIS injector beam quality. State of New York funds are anticipated to fund the construction of a building addition to house EBIS.

The project's reliance on existing and similar designs, as well as early procurement plans, reduces project risks substantially. None-the-less, the project team should confirm that issues raised at this review do not impact the risk assessment and subsequent mitigation plans. The availability of project funds from NASA has allowed the project to make early procurements and maintain an aggressive fabrication schedule. The project is being managed to an "early finish" target which yields an estimated 9-10 months of float relative to the CD-4 milestone. However, at the time of the review, a critical path analysis had yet to be completed, so the schedule and adequacy of schedule contingency could not be assessed. The early finish date is consistent with Agency needs and expectations. The advanced state of the preliminary design reduces project risk and lends credibility to the TPC. The basis for the cost estimates is sound, but the contingency analysis should be confirmed upon revision of the risk assessment and completion of the schedule planning.

The project team expressed uncertainty regarding the impact of radiation emanating from the booster synchrotron under certain failure conditions and presented a mitigation strategy with several options. These options are not costed in the project, but if necessary could be supported with contingency funds. The options will be considered after the beam port is complete and the magnitude of the problem, if any, is determined. The strategy for addressing the radiation issue involving the beam port is adequate at this stage of the project and is successful in mitigating the associated risks. Safety is clearly a priority of the project team and seems to be taken seriously.

The management structure appears reasonable overall and integrated with lab management structure. The NASA interface is well established. The level of effort of project management was increased, as recommended at last year's review. Project management has addressed all recommendations from the previous review, with the exception of the optimization of the contingency profile, which cannot be completed until the schedule planning is complete. The project management structure does not identify an overall Integration Manager. Such an appointment could provide overall technical oversight in a project whose workforce is often highly matrixed.

All project documentation required for a CD-2 request has been generated. Minor revisions are requested in this report. Upon the project's revision of project documentation and consideration of those recommendations which have been identified as necessary prior to a CD-2 request, the Office of Nuclear Physics request that the Office

of Project Assessment conduct an Independent Project Review, in preparation for a CD-2 request later in the fourth quarter of Fiscal Year (FY) 2006.

Contents

Introduction

On May 15-16, 2006, the Department of Energy (DOE) Office of Nuclear Physics (ONP) held an Annual Progress Review of the Electron Beam Ion Source (EBIS) project at Brookhaven National Laboratory (BNL), with participation from the DOE Office of Science for Project Assessment. The review committee consisted of six external consultants: Dr. Leigh Harwood (Thomas Jefferson National Laboratory), Dr. Petr Ostroumov (Argonne National Laboratory), Dr. Rod Keller (Los Alamos National Laboratory), Professor Gene Sprouse (StonyBrook University), Mr. Steve Tkacyzk (DOE Office of Project Assessment) and Dr. Martin Stockli (Oak Ridge National Laboratory). Dr. Jehanne Simon-Gillo of the ONP chaired the review. Other agency participants included Mr. James Hawkins of the ONP and Barbara Corbin, Francis Cucinotta, and Frank Sulzman of the National Aeronautics and Space Administration (NASA). This review was considered necessary by ONP in order to regularly assess the overall status of the ongoing project and its readiness for request of Critical Decision-2 (CD-2, Approve Performance Baseline) approval.

In order to perform the review, each panel member was asked to evaluate and comment on all aspects of the project's plans -- preliminary technical design, cost, schedule, management, and Environment, Safety and Health (ES&H). However, the focus of the EBIS Annual Progress Review was on understanding:

- The significance and merit of this proposed accelerator improvement project;
- The status of the technical design, including completeness of preliminary design and scope, feasibility and merit of technical approach;
- The feasibility and completeness of the proposed budget and schedule, including workforce availability;
- The effectiveness of the management structure and approach to ES&H;
- Other issues relating to the EBIS Pre-injector.

In addition to the above, the committee was asked to evaluate project documentation that will be considered for CD-2, e.g., Hazard Analysis Report, Value Management/Engineering Report, Start-Up Test Plan and Risk Management/Assessment Plan.

The review was based on formal presentations given by EBIS project staff, detailed discussions with EBIS staff, and the panel members' extensive experience. The first day was devoted to presentations given by EBIS staff and a tour of the project site. The presentations provided an overview and response to the charge letter. The second day included a Q&A session in which EBIS staff presented answers to homework assigned by the panel the previous evening and also included panel deliberations. The panel presented a closeout briefing on May 16th. The detailed agenda is included in Appendix B.

DOE Recommendations

- Prior to Critical Decision-2 (CD-2), revise the Startup Plan to incorporate comments made at the review, as well as task duration and integration.

- Prior to CD-2, re-evaluate the Systems Requirement document for consistency in parameter definition.

- End-to-end beam dynamics simulations of the LEBT-RFQ-MEBT-Linac systems, including all known types of errors, should be completed prior to completion of final design.

- Develop a detailed Quality Assurance (QA) Plan for the fabrication and testing of the Radio Frequency Quadrupole (RFQ) and include it in the final vendor contract.

- Prior to CD-2, integrate low level RF design efforts supported outside the project scope and design reviews into the project schedule.

- Perform a critical path analysis, based on a first Quarter Fiscal Year 2010 (1QFY10) project completion, prior to CD-2 and incorporate results into project planning and documentation.

- Compare the obligations profile to the funding profile. Re-assess the contingency analysis upon completion of the critical path analysis and refinement of risk assessment. Optimize the contingency profile with respect to the planned obligation profile.

- Review and adjust, as necessary, the Level 2 and 3 milestones to ensure that progress can be adequately evaluated.

- Appoint an Integration Manager to the project team.

- The risk assessment should be re-evaluated upon the completion of a critical path analysis and to incorporate feedback from this review. This should occur prior to CD-2 and the results incorporated into project planning and documentation.

Significance and merit:

Findings:

The project aims at delivering a low-maintenance injector that promises lower operating cost as compared to the presently used Tandem injectors and has a number of technical advantages: It can produce any ions such as noble gases, and Uranium; offers higher injection energy into the Booster for Au ions; allows fast switching between ion species without constraints on beam rigidity; shortens the length of the transfer line to the booster synchrotron from 860 to 30 m; reduces particle losses by enabling few-turn injection and eliminates the need for stripping before the booster. Expectations are that operation of the new injector will result in more stable beams and improved reliability, and that future improvements will lead to even higher beam intensities.

As previously recommended, a list of Critical Decision-4 (CD-4) performance specifications has been identified and incorporated into the project execution plan. The physics design parameters are the same as those proposed at CD-1. A Systems Requirements document has been generated to document specifications to support the CD-4 specifications. A Startup Plan was presented and is documented in a formal write-up which contains a large number of individual tasks, aimed at parameter values, and some background information on the logical sequence of commissioning tasks and the functional properties of subsystems.

Comments:

While the list of technical benefits is substantial, the reductions in operating costs overall are somewhat harder to quantify. A detailed analysis was generated which quantifies the savings as ~ $1.5 million per year. The Systems Requirement document is nearly complete but contains inconsistencies in description of parameters from one component to the next.

The Start-up Plan includes no indication of task duration, task integration and to what degree they could be conducted in parallel. Upon request, the sequence of events and task durations were presented. The present plan does not include timely longitudinal tuning and transverse alignment during the Linear Accelerator (Linac) commissioning. The energy spread tests with the medium energy beam transport (MEBT) and high energy beam transport (HEBT) bunchers are scheduled too late in the commissioning plan. The MEBT buncher tests should be advanced to be included in the RFQ/MEBT commissioning. The costing of the commissioning tasks seemed appropriate.

Recommendations:

- Prior to CD-2, revise the Startup Plan to incorporate comments made at the review, as well as task duration and integration.
- Prior to CD-2, re-evaluate the Systems Requirement document for consistency in parameter definition.

Technical Design:

General

A broad variety of ions will be produced with different primary ion sources that inject into the EBIS. The EBIS will increase the ion charge state of the injected ions. After reaching the desired charge state and raising the high voltage platform to about 100 kV the ions will be extracted and injected into an RFQ. After further acceleration in a linear accelerator, dipole magnets will separate the charge states and inject the beam into the Booster.

Findings:

Last year's review report stated that "the panel noted that end-to-end simulations of the LEBT-RFQ-MEBT-Linac systems are necessary prior to the finalization of the RFQ design." Simulations have been started but do not yet include a full set of errors, such as the Linac alignment errors.

Comments:

For the most complete understanding of the EBIS injector beam quality, a sensitivity analysis of beam parameters to the various errors of the accelerator components such as manufacturing errors, misalignments and dynamic errors of external fields is necessary. End-to-end beam dynamics simulation should include realistic distribution of ion beam in the phase space for all charge states at the RFQ entrance. The error simulation has been started but does not yet include full set of errors. Particularly, an error tolerance budget should be developed by studying the beam transmission, emittance growth and energy spread of the beam as a function of the amplitude of all errors. The end-to-end Monte Carlo simulations are reasonable to do with measured EBIS beam parameters for all charge states of ion beam.

Recommendations:

- End-to-end beam dynamics simulations of the LEBT-RFQ-MEBT-Linac systems, including all known types of errors, should be completed prior to completion of final design.

EBIS and LEBT

Findings:

The goal of the ongoing Research and Development (R&D) program is to develop hardware to operate on a pulsed 100kV platform, transport the extracted EBIS ion beam to the RFQ, characterize the beam, and verify design to ensure adequate performance. Activities associated with the EBIS R&D effort extend through the second quarter of Fiscal Year (FY) 2007. As recommended last year, the R&D plan has been adjusted to make the test-EBIS a permanent part of the program to serve as a test-stand for future development as well as to serve a source of hot spares.

The test EBIS was successfully moved under high vacuum and installed on the high voltage platform for ion beam injection into the future RFQ. The platform was tested to DC 100 kV. The test EBIS was operated with 6 Amps shortly afterwards. The electrical supplies, controls, and readouts have been installed on a second 100 kV platform. The system is currently operated with both platforms grounded. The preliminary design of the RHIC-EBIS control system is complete and the final design is 40% complete.

Procurements have been placed to acquire critical parts for continuing the EBIS R&D, including the HV transformer, 100 kV acceleration break, and new low energy beam transport (LEBT) chamber, all expected in ~2 months. The new EBIS collector is being procured and will be tested in an initial setup before it will be installed on the test EBIS.

The LEBT chamber detailed design is 80% complete. LEBT solenoid preliminary design is complete and the final design 75% complete. External ion sources and pulsed gas injection have been successfully tested. EBIS output emittances have been measured with the original slit-and-multi-collector scanner. A pepper-pot emittance probe with a multi-channel plate (MCP) amplified phosphor screen has been developed and successfully tested by acquiring transverse emittance data in a single EBIS pulse. A Chevron type MCP assembly has been acquired to measure the emittance of weaker beams. National Aeronautics Space Administration (NASA) funds have been used to procure the superconducting solenoid in FY 2006.

Comments:

Substantial progress has been achieved on the EBIS-LEBT part of the project, with the preliminary design complete and the detailed design well underway. The group is lauded for their effort to develop a pepper-pot emittance probe for low energy ions.

The RHIC EBIS-LEBT will be one-of-a-kind system with several sub-systems having high a-priori associated risk factors. The reliance on existing and similar designs, as well as the early procurement plans, reduces these risks substantially. The single structure of the new EBIS platform is well suited for a staged installation. The new platform has a precision rail system to move the solenoid that will significantly facilitate maintenance and alignment.

The project team should consider procuring the second collector parts promptly after the first collector has been tested. The panel supports the timely completion of the EBIS and LEBT R&D plans for demonstrating the required performance goals, further reducing risks.

Recommendations:

- None

RFQ and RF System

Findings:

The preliminary design of the RFQ system is complete and specifications for purchasing have been developed. The RFQ will be procured from the University of Frankfurt and the contract is anticipated to be fixed price contract. A Memorandum of Understanding (MOU) has been signed with Frankfurt on the collaboration to develop and construct accelerator components. The preliminary design of the high power Radio Frequency (RF) system and development of specifications for purchasing are complete. The high power RF system represents the most expensive Work Breakdown Structure (WBS) element in the project. The low level RF design is based on a design being developed for RHIC and the procurement of the hardware components is included in the project costs.

Comments:

The RFQ procurement is advanced for this stage of the project. The contingency associated with the procurement is ~30%. This level of contingency seems appropriate for this foreign vendor. The mitigated risk has been categorized as low, but in light of the fact that a fixed price contract has not yet been signed with the University of Frankfurt, the risk assessment should be revisited. The vendor has built many similar RFQ's and the probability of receiving a high-quality RFQ appears high. The project team should have a thorough understanding of the design and fabrication technology of the RFQ.

A set of specifications has been generated for the RFQ procurement for review by the University of Frankfurt. Although some information is included regarding Quality Assurance (QA) tests, it is incomplete. The acceptance tests at BNL are not defined, for example, and the QA tests under the responsibility of Frankfurt could benefit from additional specificity.

Many uncertainties of the initial tune-up process could be eliminated by using a single charge state as a pilot beam. The project team should consider for the initial commissioning and set-up of focusing and accelerating fields the use of He 1+ if this beam is relatively easy to produce in the EBIS. Use of the He beam with q/m=0.25 will provide the accelerator tunes that can be scaled easily for acceleration of both to Au and Fe beams.

The procurements for the high power RF system seem straightforward and represent low technical risk.

Recommendations:

- Develop a detailed QA Plan for the fabrication and testing of the RFQ and include it in the final vendor contract.

Linac

Findings:

The preliminary design of the Linac is complete. The vendor for the procurement of the Linac is still being considered and will be either with the University of Frankfurt or an outside vendor. If an outside vendor is chosen, then a consultant from Frankfurt could be involved in the procurement. The specifications and contract have not yet been generated. It is anticipated that the procurement will be fixed price. The contingency associated with the Linac procurement is ~ 30% and the risk has been categorized as low.

Comments:

The design is based on a similar existing design that has been in operation for over 20 years, lending to a low technical risk. Although the Frankfurt group has a good track record for producing working devices, this procurement represents some cost and schedule risk, particularly as a signed contract is not yet in place. The vendor decision should be made as soon as possible. The risk associated with this procurement, in light that a procurement approach has not yet been developed, should be re-assessed.

Recommendations:

- None

MEBT-HEBT

Findings:

The MEBT was originally designed to use available quadrupole magnets from Los Alamos National Laboratory (LANL). Beam simulations showed that existing LANL and BNL magnets, would lead to unacceptable transmission. The technical scope of the project now includes the design and procurement of the magnets. The preliminary design of the MEBT is complete. The preliminary design of the HEBT magnets is complete. The preliminary design of all beam monitors is complete. The final design is ~60% complete.

Comments:

As presented, there were inconsistencies in the HEBT dipole design which could point to the benefits of a project Integration Manager. The matching of the longitudinal phase space of the Linac output to the acceptance of the booster requires buncher elements in the HEBT. The bunchers will likely be part of the Linac procurement. It will be important to carefully include detailed specifications for the bunchers in the contract vendor.

The beam diagnostics system required for the commissioning and operation of the EBIS injector seems well understood. The ion source team has developed efficient beam instrumentation which has been tested to provide measurements of beam energy spread, beam emittance and other beam parameters.

Recommendations:

- None

Facility Modifications

Findings:

Two facility modifications are needed: upgrading the power system in the Linac building 930 and the new building addition and inserting a beam port between the Linac building and the booster synchrotron tunnel. The power system modification will be planned utilizing an existing spreadsheet that was modified for the needs of this project and calculates requirements for installed power as well as cable specifications on the base of nominal power ratings and heat load values for individual devices.

The addition to building 930 is funded by the State of New York and outside the scope of this project. The beam port preliminary design is completed, and the final design has progressed to an estimated 75% of completion. The project team expressed uncertainty regarding the impact of radiation emanating from the booster synchrotron under certain failure conditions and presented a mitigation strategy with several options. These options are not costed in the project, but if necessary could be supported with contingency funds. The options will be considered after the beam port is complete and the magnitude of the problem, if any, is determined.

Comments:

The planning for the power system modification is advanced and implies rather low cost and schedule risks. The strategy for addressing the radiation issue involving the beam port is adequate at this stage of the project and is successful in mitigating the associated risks.

Recommendations:

- None

Budget and Schedule:

Findings:

The overall project cost is $19.3 million in as-spent dollars, unchanged from the previous review. NASA is contributing $4.5 million and DOE is contributing $14.8 million. The DOE project contingency is 18%; it is 27% for the NASA scope; overall it is 20%. The escalation rates used are the standard DOE escalation rates.

The project is being managed to an "early finish", with a claimed 9-10 months of float relative to the proposed CD-4 (2nd Quarter FY 2010 (2QFY10)). DOE support for R&D was provided in FY 2005 and FY 2006. DOE funds are provided for Project Engineering and Design (PED) in FY 2006-FY 2007, and construction of DOE scope is proposed to start in FY 2007. NASA support was initiated in FY 2005 with funds for long lead procurements. NASA construction funds are planned through FY 2008 and $600,000 of R&D funds were also provided in FY 2006.

Design progress at the end of April stood at 43% (estimate) of the total planned PED with 38% of the budget having been expended. 34.4 Full Time Equivalents (FTE) of labor over the project duration are in the project planning. This translates to ~9 FTE's a year using >15 individuals. The project intends to add an accomplished accelerator physicist, and project planner/scheduler this year. 40% of the estimate is labor, which is largely based on RHIC and Spallation Neutron Source (SNS) experience. 60% is materials.

CD-2 and 3 are planned for 4QFY06 and 1QFY07, respectively. The project is using financial tracking and reporting tools and methodology which have been used previously for BNL's portion of the SNS project and also for ongoing CA-D activities. State of New York funds are anticipated to fund the construction of a building addition to house EBIS.

The project team responded to last year's review recommendations by:

- Requesting and receiving an advance of NASA funds;
- Assessing the possibility of using phased funding to advance the Linac and dipole procurements;
- Establishing separate accounts for PED and construction funds;
- Adjusting the costing of scientist labor to be in accordance with DOE/NP guidance; and
- Increasing the level of PED workforce.

A critical path analysis is still under development.

Comments:

The financial tracking/reporting process and staff has extensive experience that will stand the project management team in good stead, and seem willing to adjust their reports to the particular needs/preferences of the project team. The project team should continue the

use of design reviews before procurement, as well as integrated design reviews. The planned reviews should be incorporated into the project schedule.

The project milestones after CD-2 seem appropriately distributed across the project duration, although the distribution between NASA and DOE milestones should be confirmed prior to CD-2. Milestones should also be indicative of progress in R&D, design, as well as construction activities. The Project is leveraging available resources (excess capacity in the NASA Space Radiation Laboratory (NSRL) cooling water; funding from New York) to constrain the project costs. Controls for the low level RF will use a design being developed with RHIC capital equipment funds. That development is not linked into the EBIS schedule.

A contingency of 20% at this point of the project may be low. The contingency analysis should be revisited after the risk assessment has been revised. Labor has a lower contingency level than procurements, which may be optimistic. Project management should ensure that a consistent methodology for base labor estimates be utilized, and include field supervisors in making the estimates.

The proposed project schedule needs to be better understood before proceeding to CD-2. The schedule contingency needs to be reassessed in the context of a more refined risk analysis. A critical path analysis needs to be complete before project schedule float can be defined. The project completion and CD-4 date should be optimized to the mission needs of the funding agencies (1QFY10).

<u>Recommendations:</u>

- Prior to CD-2, integrate low level RF design efforts supported outside the project scope and design reviews into the project schedule.
- Perform a critical path analysis, based on a 1QFY10 project completion, prior to CD-2 and incorporate results into project planning and documentation.
- Compare the obligations profile to the funding profile. Re-assess the contingency analysis upon completion of the critical path analysis and refinement of risk assessment. Optimize the contingency profile with respect to the planned obligation profile.
- Review and adjust, as necessary, the Level 2 and 3 milestones to ensure that progress can be adequately evaluated.

Management and Project Documentation:

Findings:

A Project Management structure is established and documented in the Project Execution Plan (PEP). An Integrated Project Team has been assembled. The project is organized into a WBS for purposes of planning, managing and reporting of activities.

The Baseline Change Control process is established in the PEP. Project Controls are established for baseline cost and schedule management and progress reporting.

The project is jointly funded by DOE and NASA. Management of the project is the responsibility of the DOE. An Implementation Agreement between DOE and NASA was put in place over the last year. The detailed allocation of the DOE and NASA contributions are documented in the PEP. The project will be required to undergo an Independent Project Review (IPR) (required for CD-2).

A risk based contingency assessment methodology has been developed. The project has prepared an assessment of the risks associated with the project. A comprehensive Hazard Screening Report has been prepared. The Safety Assessment Document (SAD) is to be completed by FY 2008. The National Environmental Policy Act (NEPA) process is completed. Five safety reviews have been held since the last DOE annual review. Value Engineering (VE) is being performed during the preliminary engineering phase of the project. The process was documented and five examples were given in a VE report. An Integration Manager has not been identified in the management structure.

Comments:

The WBS appears reasonable and consistent with the discrete increments of project work. The WBS dictionary is comprehensive. The Project Management Control System appears to be appropriate for this size project.

The management structure appears reasonable overall and integrated with lab management structure. Overall, there are clear roles, responsibilities and accountability. The roles and responsibilities of a possible Deputy were not clear. There is no Deputy in the PEP, but the concept of a Deputy was presented at the review. The roles and responsibilities of this position should be clarified and included in the PEP if appropriate.

The NASA interface is well established. The level of effort of project management was increased, as recommended at last year's review. Project management has addressed all recommendations from the previous review, with the exception of the optimization of the contingency profile, which cannot be completed until the schedule is better understood. The project management structure does not identify an overall Integration Manager. Such an appointment could provide overall technical oversight in a project whose workforce is often highly matrixed.

Risk management seems to be taken seriously by project management and frequently discussed. The application of the risk based contingency methodology requires refinement in order to support the project baseline at CD-2. Safety management seems to be taken seriously by project management. Environmental aspects and potential hazards have been well identified and comprehensive plans are in place to adequately address all issues.

The value engineering process may be adequate but was not well presented. The project team should continue the value-management efforts into the Final Design phase.

Recommendations:

- Appoint an Integration Manager to the project team.
- The risk assessment should be re-evaluated upon the completion of a critical path analysis and to incorporate feedback from this review. This should occur prior to CD-2 and the results incorporated into project planning and documentation.

Appendix A: Charge Memorandum

Thank you for agreeing to participate as a review panel member for the Annual Progress Review of the Electron Beam Ion Source (EBIS) Pre-injector for the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory (BNL). This review is being organized with input and participation from the Department of Energy (DOE) Office of Project Assessment and is scheduled for May 15-16, 2006 at BNL in Upton, New York. A list of the members of the Review Panel and anticipated DOE and National Aeronautics and Space Administration (NASA) participants is enclosed.

Each panel member is being asked to evaluate and comment on any relevant aspect of the EBIS project. However, the focus of this review is to assess all aspects of the project's plans -- preliminary technical design, cost, schedule, management, and Environment, Safety and Health (ES&H), as well as reviewing project documentation that will be considered for Critical Decision 2 (CD-2, Approve Performance Baseline), e.g., Hazard Analysis Report, Value Management/Engineering Report, Start-Up Test Plan and Risk Management/Assessment Plan. The following main topics will be considered at the review:

- The significance and merit of this proposed accelerator improvement project;
- The status of the technical design, including completeness of preliminary design and scope, feasibility and merit of technical approach;
- The feasibility and completeness of the proposed budget and schedule, including workforce availability;
- The effectiveness of the management structure and approach to ES&H;
- Other issues relating to the EBIS Pre-injector.

Each panel member is asked to review these aspects of the proposed EBIS and write an individual "letter report" on his/her findings. These "letter reports" will be due at DOE two weeks after completion of the review. We take care to keep the identity of the reviewers confidential in the summary report. It would be convenient if you would prepare your response in a form suitable for transmittal to the proponents devoid of potentially identifying information. The cover letter may include other remarks you wish to add. As Chair, I will accumulate the "letter reports" and compose a final summary report based on the information in the letters.

The Laboratory has been asked to provide relevant background materials prior to the review. This documentation, along with a current agenda, will be distributed in the near future. The first day will consist of presentations by the laboratory and executive sessions. The second day will be used for a Question and Answer (Q&A), an executive session and preliminary report writing; a brief close-out will end at 3:00 p.m. Preliminary findings, comments and recommendations will be presented at the close-out.

If you have any questions about the review, please contact myself at (301)-903-1455, or E-mail Jehanne.Simon-Gillo@science.doe.gov, if you have any questions regarding local travel, lodging, or other local logistics, please contact Sandy

Asselta at BNL at (631)-344-4550 or E-mail: sandylee@bnl.gov. I greatly appreciate your willingness to assist us in this review. I look forward to very informative and stimulating discussions at BNL.

Sincerely,

Jehanne Simon-Gillo
Director
Facilities and Project Management Division
Office of Nuclear Physics

Enclosure

Appendix B: Agenda

Department of Energy Review
of the
Electron Beam Ion Source Project (EBIS)
Brookhaven National Laboratory

Building 490
Medical Research Center Conference Room

May 15 – 16, 2006

AGENDA

Monday, May 15, 2006

08:00 Executive Session – FPD Perspective, Charge .....

08:30 Welcome .....P. Bond

08:45 Project Overview .....J. Alessi

09:45 R&D Status .....E. Beebe

10:15 Break

10:30 Physics Status and Startup / Commissioning Plan.....D. Raparia

11:15 Preliminary Engineering Status and Preliminary Design Status.....L. Snydstrup

12:15 Lunch

13:30 ES&H.....E. Lessard

14:00 Cost, Schedule, Risk Management, etc.....K. Mirabella

14:45 Description of Financial Tracking System .....S. LaMontagne

15:15 Break/Tour

16:15 Executive Session

19:00 Dinner

Tuesday, May 16, 2006

08:30 Homework Assignments, Q&A

09:30 Break Out Sessions – TBD

11:00 Executive Session

12:30 Lunch

13:30 Report Writing

16:00 Closeout

16:30 Adjourn